# THE FAUNA OF THE KEYSER MEMBER OF THE HELDERBERG FORMATION IN MARYLAND

A DISSERTATION
Submitted to the Board of University Studies of The Johns Hopkins University
in conformity with the requirements for the degree of
Doctor of Philosophy

BY
THOMAS POOLE MAYNARD

BALTIMORE
THE JOHNS HOPKINS PRESS
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BY

THOMAS POOLE MAYNARD[1]

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# MOLLUSCOIDEA

## CLASS BRACHIOPODA

### Order PROTREMATA

#### Superfamily ORTHACEA

#### Family ORTHIDAE

Genus DALMANELLA Hall and Clarke

DALMANELLA CLARKI n. sp.

Plate LIV, Figs. 7-10[2]

*Description.*—Subcircular to transversely subelliptical in outline, wider than long, hinge-line shorter than the greatest width of the shell. Pedicle valve very convex, very gibbous to ventricose, beak pointed and strongly incurved and arched over the cardinal area. Brachial valve depressed convex with a well-defined mesial sinus, which extends from the beak to the front, narrow at the beak and becoming gradually wider towards the front; beak small, pointed, incurved, extending only slightly above the hinge-line. The surface of both valves marked by fine radiating striæ,

[1] Manuscript submitted June, 1909.

[2] All references to figures are to the Lower Devonian report of the Maryland Geological Survey in which the plates and text were published.

which are prominent and well defined. They increase toward the margin by implantation. The striæ may be alternately coarse and fine, or there may be several fine striæ between the coarser ones. Internally the ventral valve is not usually well preserved. The vascular area is small and not usually well defined. The teeth which diverge from the beak, are prominent, rounded, and become thicker towards their extremities. In the dorsal valve the cardinal process is prominent and on both sides of it are strong divergent dental lamellæ which are produced forward and extend to at least the middle of the valve, converging toward the central prominent ridge which extends from beneath the beak to the base, and circumscribes a suboval muscular area. Dimensions of an average specimen: Length 6.5 mm.; width 8 mm.

*Dalmanella clarki* may be distinguished from *Dalmanella postelegantula* of the Decker Ferry in being smaller while the sinus of the brachial valve extends from the beak to the front. It differs from *Dalmanella elegantula* of the Clinton and Niagara in being wider than long, while the brachial valve is more convex and the mesial sinus more conspicuous. It differs from *Dalmanella subcarinata* in having the brachial valve more convex, but not subcarinate.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley.

*Collection.*—Maryland Geological Survey.

### DALMANELLA CONCINNA (Hall)

Plate LIV, Figs. 11-13

*Orthis concinna* Hall, 1859, Pal. N. Y., vol. iii, p. 172, pl. x*a*, figs. 1-3, 1861.
*Dalmanella concinna* Hall and Clarke, 1892, Pal. N. Y., vol. viii, pt. 1, pp. 207, 224.

*Description.*—"Shell longitudinally semielliptical: valves unequally convex: hinge-line straight, with the extremities subangular. Dorsal valve convex, with a depression from beak to base, on each side of which the shell is more convex, and thence sloping somewhat abruptly to the sides: beak very small and scarcely incurved. Ventral valve very convex, gibbous, and almost subcarinate in the middle: beak prominent, much

elevated above the hinge-line, and neatly incurved over the area. Area comparatively large, the length greater than half the width of the shell. Surface very finely and evenly striated. This species bears some resemblance to *O.* [*Dalmanella*] *elegantula* of the Niagara group; but it is more finely and beautifully striated, the dorsal valve is more gibbous, . . . . and the beak less arched." Hall, 1859.

Certain individuals referred to this species are much more circular in outline than the forms described by Hall, the cardinal angles being less extended and the valves less elongate.

Concerning this species Schuchert remarks that it "is easily confounded with *Dalmanella perelegans,* but it is always smaller, more obese, and with finer striæ. Hall states that these specimens are from the "shaly limestone of Cumberland, but is in error, since all those now found are from the Keyser member, and none have been seen in the New Scotland member."

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia; Cash Valley, Devil's Backbone, Market Street Bridge, Cumberland, section southwest of Rawlings, Pinto, Viaduct Cumberland, Tonoloway, Maryland; Pleasant Valley, Bedford County, and Hyndman, Pennsylvania.

*Collection.*—Maryland Geological Survey.

## Genus RHIPIDOMELLA Œhlert[1]

### RHIPIDOMELLA EMARGINATA (Hall)

Plate LV, Figs. 1-8

*Orthis oblata* var. *emarginata* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 164, pl. x*a*, figs. 4-6, 1861.

*Description.*—"Among the collections from the Lower Helderberg rocks of Cumberland, Maryland, there are numerous specimens of an *Orthis,* having the same general characters as *O. oblata,* but proportionally narrower and the beak more extended. The dorsal valve is very convex, and the ventral valve is marked by an undefined depression, which, beginning

[1] See Hall and Clarke, 1892, Nat. Hist. N. Y., Pal., vol. viii, pt. i, p. 209.

below the beak, gradually becomes wider and deeper, producing a deep sinuosity or emargination in front.

"The vascular area of the ventral valve occupies a comparatively greater space than in shells of *O. oblata* from the Helderberg, and it is more elongated or triangular in form. In the dorsal valve, the double imprints of the adductor muscles are well preserved." Hall, 1859.

The forms collected in Maryland by the writer differ from those figured by Hall in having the lateral margins well rounded; giving to the shell a much more circular appearance than the somewhat subtriangular outline of those figured by Hall.

*Rhipidomella emarginata* resembles somewhat *Dalmanella quadrans* and *Dalmanella concinna* but seldom assumes the subquadrate shape which characterizes both these species.

Length of average specimen about 1.5 cm.; width about 1.7 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, near Bloomfield, West Virginia; Cash Valley, Cumberland, Maryland.

*Collections.*—Maryland Geological Survey, U. S. National Museum.

## Superfamily STROPHOMENACEA

### Family STROPHOMENIDAE

#### Genus LEPTÆNA Dalman

#### LEPTÆNA RHOMBOIDALIS (Wilckens)

Plate LVI, Figs. 13-17

*Conchita rhomboidalis* Wilckens, 1769, Nachricht von selten Versteinerungen, p. 77, pl. viii, figs. 43, 44.
*Leptæna depressa* Hall, 1852, Pal. N. Y., vol. ii, p. 257, pl. liii, figs. 6*a*-6*l*.
*Strophomena rugosa* Hall, 1859, Pal. N. Y., vol. iii, p. 195, pl. xix, fig. 1.
*Leptæna rhomboidalis* Hall and Clarke, 1892, Pal. N. Y., vol. viii, pt. i, 1892, p. 279; pl. viii, figs. 17-31; pl. xv*a*, figs. 40-42; pl. xx, figs. 21-24.

*Description.*—"Shell semioval or semicircular; hinge-line equal to or extending beyond the width of the shell; dorsal valve having the upper part nearly flat, slightly convex or even concave, with strong concentric undulations, towards the margin abruptly inflected; ventral valve parallel to the dorsal valve, presenting a deep concavity. Surface marked by prominent radiating striæ. The cardinal area is narrow and extended to

the extremities of the hinge-line; the foramen is broad and spreading, but filled by a callosity of the ventral valve, which has a narrow groove at its summit for the protrusion of the pedicle; the apex of the dorsal valve is often, and perhaps always, perforated. The flatter portions of both valves are strongly marked by concentric undulations, which are crossed by fine striæ. On the deflected portions there are no undulations, the striæ alone marking the surface. Sometimes the shell is nearly flat, the deflected portion being either very narrow, or not at all conspicuous. The undulations are variable in number, even in shells of the same size, and are not to be relied upon as characteristic; and in very old shells they are not so strong as in younger ones, or those of medium size. The striæ crossing the undulations are likewise variously prominent in different individuals, frequently bifurcating, and in well-preserved surfaces are crossed by fine concentric striæ. The interior structure is always peculiar and sufficiently characteristic, though the exterior characters are very closely simulated by a different shell in the shaly limestone of the Helderberg.

"This species has a wide range, occurring in the Clinton group and ranging to the Upper Helderberg limestones." Hall, 1852.

This species is found also in the Clinton and Oriskany of Maryland.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Corriganville, Cash Valley, Pinto, Tonoloway, Maryland; Hyndman, Pennsylvania. COEYMANS MEMBER. Dawson, Corriganville, Devil's Backbone. NEW SCOTLAND MEMBER. 21st Bridge, Dawson, Corriganville, Miller's Spring, Ernstville, Maryland; Cherry Run, West Virginia. BECRAFT MEMBER. Warren Point, Pennsylvania. ORISKANY FORMATION, RIDGELY MEMBER. Miller's Spring, near Cumberland.

*Collections.*—Maryland Geological Survey, U. S. National Museum.

### Genus STROPHEODONTA Hall

### STROPHEODONTA VARISTRIATA (Conrad)

Plate LIX, Figs. 1, 2

*Strophomena varistriata* Conrad, 1842, Jour. Acad. Nat. Sci. Phila., vol. viii, p. 255, pl. xiv, fig. 6.

*Strophodonta varistriata* Hall, 1859, Pal. N. Y., vol. iii, p. 180, pl. viii, figs. 1-16; pl. xvi, figs. 1-8, 1861.

*Stropheodonta varistriata* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 427.

*Description.*—" Shell semioval, varying in form from length and width equal to length greater or less than the width: hinge-line equal to or greater than the width of the shell below; extremities rounded or salient. Dorsal valve flat, or more or less concave according to the convexity of the ventral valve, but not conforming entirely to the curvature of the latter. Ventral valve varying from slightly convex to gibbous, and sometimes abruptly arching towards the front; umbonal region more or less prominent; beak usually a little elevated. Area narrow, almost linear. Foramen linear or none.

" Surface often finely and evenly marked with straight or slightly undulating striæ; more often with prominent sharp striæ at more or less equal distances from each other, and the intermediate spaces by minute equal striæ; and again in other specimens by alternating larger and smaller striæ, of which there are frequently three regular gradations in size. Radiating striæ crossed by fine concentric elevated lines, and often by undulations or indentations which are more conspicuous on those shells where the striæ are in fascicles of finer between stronger ones. Vascular impressions of the ventral valve circumscribed by lamellæ, more or less distinctly flabellate: impressions of adductor muscles elongate-oval." Hall, 1859.

Length 1.1 cm. to 1.9 cm.; width 1.5 cm. to 2.5 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley, Maryland; Hyndman, Pennsylvania.

*Collection.*—Maryland Geological Survey.

### STROPHEODONTA (LEPTOSTROPHIA) BIPARTITA (Hall)

Plate LVII, Figs. 17, 18

*Leptæna bipartita* Hall, 1858, Pal. N. Y., vol. ii, p. 326, pl. lxxiv, figs. 4, 5.
*Strophеodonta nearpassi* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 427.
*Strophеodonta textilis* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 427.
*Strophomena* (?) *bipartita* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 429.
*Strophеodonta bipartita* Weller, 1903, Pal. N. J., vol. iii, p. 226, pl. xx, figs. 1-5.

*Description.*—" Shell with thin, nearly flat brachial valve and slightly convex pedicle valve, longitudinally subsemielliptical in outline, the

hinge-line produced beyond the body of the shell into mucronate extensions, hinge-line crenulate.

" Surface of both valves marked by fine, irregularly alternating, angular, raised striæ, which are not continuous over the umbo to the beak, and which curve outward on the sides of the shell in passing to the margin, the curvature becoming stronger on approaching the hinge-line. The surface is also marked by much finer, crowded, concentric lines, which continue to the beak. Oblique wrinkles along the cardinal margin are present in many specimens. The interior of the valves, more especially the pedicle, is covered with fine, closely crowded papillæ, which gives to the surface of internal casts a finely pitted or punctate appearance. These internal papillæ may frequently be detected through the thin shell substance as dark spots, giving it a punctate appearance, but there are apparently no perforations. The muscular impressions of the pedicle valve are rather large and divergent and are free from impressions of papillæ. In the interior of the brachial valve a low median ridge reaches more than half way to the front of the shell.

" The dimensions of a medium-sized specimen are: Length, 28 mm.; breadth, 30 mm." Weller, 1903.

This species is the same as *Stropheodonta bipartita* which Weller describes from the Decker Ferry of New Jersey and which he considers the same as the three shells described by Hall in Volume II of the Paleontology of New York under the names *Leptæna* sp., *Leptæna bipartita,* and *Stropheodonta textilis,* all from the Coralline limestone of Schoharie, New York. It differs from the three forms described by Hall in having the striæ curve outwards on the sides of the shell in approaching the margins, the curvature increasing towards the posterior portion of the shell. This curvature is not mentioned in Hall's description and on examining the type material the striæ do not curve but radiate from the beak straight. While this form is the same as that described by Weller it may prove to be a distinct species from Hall's.

It is distinguished from *S. planulata* of the Lower Helderberg by the curvature of the alternating angular striæ, while the striæ of *S. planulata* are fine and even.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Hancock, Cookerly, $1\frac{3}{4}$ miles northeast of Flintstone, Pinto, Maryland; Hyndman, Pennsylvania.

*Collection.*—Maryland Geological Survey.

### Genus STROPHONELLA Hall[1]

### STROPHONELLA GENICULATA (Hall)

Plate LIX, Figs. 3-5

*Strophodonta geniculata* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 483, pl. xxiii, figs. 6*a*, 6*b*, 6*c*, 1861.

*Description.*—"Shell somewhat semicircular, abruptly geniculate towards the base. Dorsal valve flat for two-thirds the length of the shell, when it is abruptly inflected. Ventral valve with a narrow area, the beak projecting a little beyond the opposite, slightly convex from the beak towards the middle, becoming flattened and concave, and the last third abruptly deflected, corresponding with the opposite valve. Surface at and near the beaks marked by strong radiating striæ, which bifurcate, and are increased by interstitial additions towards the base of the shell. Tubular openings are noticed at intervals on the summits of the stronger striæ, and round or oval pores mark the interstitial spaces.

"In some specimens the center of the dorsal valve is marked by a strong sinus with a prominent elevation on each side, with a corresponding mesial elevation on the center of the opposite or concave valve, and a sinuosity on either side." Hall, 1859.

Some specimens from Tonoloway are larger than those described by Hall and have much coarser striæ. They are questionably referred to this species. It is cited by Hall as coming from the lower Helderberg rocks of Cumberland.

Length about 1 cm.; width 1.8 cm.

[1] This genus is readily distinguished from Stropheodonta in having the relative convexity of the valves reversed. In other words, Stropheodonta is plano-convex or concavo-convex, while in Strophonella a section along the middle from the beak to the anterior margin will be sigmoid in outline. Otherwise the two genera are essentially alike. See Hall and Clarke, 1892, Nat. Hist. N. Y., Pal., vol. viii, pt. i, pp. 290-293.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Viaduct Cumberland, Cash Valley, Tonoloway, Maryland; Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

Genus SCHUCHERTELLA Girty

SCHUCHERTELLA DECKERENSIS (Weller)

Plate LX, Figs. 13-16

*Orthothetes deckerensis* Weller, 1903, Geol. Survey N. J., Pal., vol. iii, pp. 229-230, pl. xx, figs. 6-7.

*Description.*—" Shell subplano-convex, transversely subelliptical in outline, the hinge-line shorter than the greatest width of the shell, which is near the middle. Pedicle valve depressed, the umbonal region usually irregularly concave; the concave area, having been a facet of attachment to some external object, retains the reverse of the contour of the object to which the shell was attached. Between the umbonal concavity and the margin this valve is marked by one or more conspicuous, more or less irregular, concentric wrinkles, with less conspicuous intermediate ones. The cardinal area is unsymmetrical and variable because of the attachment of the shell, but it is always rather low; its margin is sometimes sharply defined, but it is often very poorly defined. The brachial valve is more or less regularly convex, the greatest convexity usually being posterior to the middle; it is never so strongly marked by concentric wrinkles as the opposite valve. Both valves marked by fine, more or less unequal, radiating ribs, of which three or four occupy a space of 1 mm. at the margin of the shell. The larger ribs extend the entire length of the shell, while the shorter ones are intercalated at various distances from the beak.

" The dimensions of a rather large pedicle valve are: Length 20.5 mm.; width 25.5 mm.; height of area at center 3 mm.; maximum depth of valve 4.5 mm. A brachial valve having the same length and breadth has a convexity of 9 mm.

" This species differs greatly from any other Silurian species of the genus, having a much closer resemblance to younger forms such as *O. chemungensis* of the Devonian and some Carboniferous species. It differs

from any of these younger forms, however, in its much larger facet of attachment upon the umbo of the pedicle valve." Weller, 1903.

Most of the individuals referred to this species do not show the strong wrinkles observed in the individuals from New Jersey while the area is higher at times. They also attain a larger size, a large individual being 27 mm. long and 31 mm. wide, convexity of brachial valve 10 mm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia; Pinto, Devil's Backbone, Market Street Bridge Cumberland, Cookerly, Cash Valley, 1¼ miles east of Rush, Maryland.

*Collection.*—Maryland Geological Survey.

### SCHUCHERTELLA DEFORMIS (Hall)

Plate LXI, Figs. 1, 2

*Orthis deformis* Hall, 1857, Tenth Rept. N. Y. State Cab. Nat. Hist., p. 44.
*Orthis deformis* Hall, 1859, Pal. N. Y., vol. iii, p. 174, pl. x*a*, fig. 13; pl. xv, fig. 3, 1861.
*Orthothetes deformis* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, pp. 296-297.

*Description.*—"Shell suborbicular, lenticular. Ventral valve more convex than the opposite, most elevated between the center and beak: beak straight, or often distorted in consequence of having been the point by which the shell was attached. Dorsal valve depressed convex, most elevated near the beak: beak not extending beyond the hinge-line. Hinge-line straight, equalling about three-fourths the width of the shell. Area broad, flat, sometimes nearly on a plane with the axis of the shell. Foramen closed above, and filled below by the strong cardinal process. Surface marked by prominent rounded striæ, which increase by implantation, and are crossed at intervals by distinct subimbricating concentric lines of growth. The striæ are distinctly tubular, with openings at the more conspicuous lines of growth. The fine concentric striæ are often scarcely visible in the silicified specimens." Hall, 1859.

Length about 4 cm.; width about the same.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Cash Valley.

*Collections.*—Maryland Geological Survey, U. S. National Museum.

### SCHUCHERTELLA SINUATA (Hall and Clarke)

Plate LXI, Figs. 3, 4

*Orthothetes deformis* var. *sinuatus* Hall and Clarke, 1892, Nat. Hist. N. Y., Pal., vol. viii, pt. i, pl. 20, figs. 8 and 9.

*Description.*—Two views of a specimen are figured but not described by Hall and Clarke, which show the distortion of the beak and the median sinus on the brachial valve. Hall says "Further examination will probably prove this form to be a distinct species." This fossil was collected at Cumberland, Maryland, by Hall and is cited from the rocks of the Lower Helderberg. The individual at hand consists only of the brachial valve.

Brachial valve transversely subelliptical in outline, wider than long, extremely convex, gibbous, greatest convexity about 3 mm., anterior to the beak, sloping somewhat abruptly to the lateral margins, there becoming plane to concave. Hinge-line straight and less than the greatest width of the shell. Lateral and front margins rounded; beak strongly incurved. A somewhat shallow sinus extends from the beak to the front, gradually becoming broader from the beak anteriorly. Surface marked by well-defined simple tubular ribs which increase by interstitial addition and implantation.

Dimensions: Length 17 mm.; width 22 mm.

This species differs from *Schuchertella deformis* in (1) having the dorsal valve extremely convex, (2) being transversely subelliptical in outline while *S. deformis* is suborbicular lenticular, (3) having a well-defined sinus in the dorsal valve.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone. Beneath the *Gypidula coeymanensis* var. *prognostica zone.*

*Collections.*—U. S. National Museum, American Museum of Natural History.

### SCHUCHERTELLA MARYLANDICA n. sp.

Plate LXI, Figs. 5-9

*Description.*—Shell plano-convex, subelliptical in outline. Length greater than the width. Lateral and anterior margins rounded. Hinge-line straight, about two-thirds the greatest width of the shell. Cardinal area high, triangular in outline. Pedicle valve convex, ventricose along

the median portion and descending rather abruptly towards the lateral margins. Greatest convexity about 7 mm. anterior to the beak, beak only slightly incurved, prominent, and extending high above the beak of the dorsal valve.

Dorsal valve plano-convex to depressed convex; beak straight and extending to the hinge-line. A medial sinus extends from the beak to the base, which is narrow at the beak and gradually wider anteriorly and contains three or four radiating ribs. A slight emargination is produced where the dorsal sinus meets the ventricose portion of the ventral valve at the base of the shell. Surface of both shells marked by strong radiating simple rounded ribs which extend from the beaks to the base of the shell and increase by implantation and interstitial addition, and are crossed by faint concentric lines of growth.

This form is not easily confused with any other species.

Dimensions: Length 16.5 mm.; width 14 mm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cumberland, Maryland; Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## Family PRODUCTIDAE

### Genus CHONETES Fischer de Waldheim

### CHONETES JERSEYENSIS Weller

Plate LXI, Figs. 17-19

*Chonetes jerseyensis* Weller, 1900, Ann. Rept. Geol. N. J. for 1899, p. 8.
*Chonetes jerseyensis* Weller, 1903, Geol. Surv. N. J., Pal., vol. iii, p. 230, pl. xx, figs. 11-16.

*Description.*—"Shell concavo-convex or nearly plano-convex, length about two-thirds the breadth, hinge-line usually a little shorter than the greatest breadth, lateral and anterior margins regularly rounded. Pedicle valve depressed convex, the greatest convexity near the beak: beak small, not prominent; cardinal area low, with as many as seven slightly oblique marginal spines on each side of the beak upon the larger specimens. Brachial valve slightly concave or nearly flat. Both valves marked by rather coarse, radiating ribs, which increase by implantation and bifurcation, three or four of them occupying a space of 2 mm. at the

front margin. On the younger shells the ribs are usually finer and more angular and the lateral ones often have a slight anterior curvature as they approach the margin. As the shells increase in size this peculiar curvature of the ribs becomes more and more conspicuous, and can always be detected to a greater or less degree in the adult individuals, and it is always more conspicuous in the brachial than in the pedicle valve. Just anterior to the beak in both valves there is a small area where the radiating ribs are obsolete. In addition to the radiating ribs, both valves are marked by exceedingly fine, concentric lines.

"The dimensions of a large individual are: Length 14 mm. and width 22 mm." Weller, 1903.

This species is an exceedingly variable one in form. The larger specimens may be recognized by the peculiar curvature of the radiating ribs, while in the smaller or younger specimens the ribs may be straight or in others have the peculiar curvature.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Dawson, Cookerly, Cash Valley, Devil's Backbone, Breakneck Hill, Flintstone, 1¼ miles east of Rush, Hancock, Tonoloway, Maryland; Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

### CHONETES JERSEYENSIS VAR. SPINOSUS n. var.

Plate LXI, Fig. 20

*Description.*—This variety of *Chonetes jerseyensis* differs in being larger and having a greater number of marginal spines on each side of the beak. Pedicle valve slightly more convex. The radiating ribs are coarser and somewhat nodose.

Length 17 mm.; width 22 mm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Hancock.

*Collection.*—Maryland Geological Survey.

## Superfamily PENTAMERACEA

### Family PENTAMERIDAE

#### Genus GYPIDULA Hall

GYPIDULA (SIEBERELLA) COEYMANENSIS VAR. PROGNOSTICA n. var.

Plate LXII, Figs. 9-11

*Description.*—Shell subovoid to longitudinally subglobose, length greater than the breadth. Ventral valve convex, quite gibbous to subventricose; beak pointed, arched and strongly incurved, but not closely incurved over that of the opposite valve. Dorsal valve convex, subcircular to transversely elliptical, slightly gibbous in the umbonal region; beak incurved, extending to that of the opposite valve and beneath it. Surface marked by rather indistinct plications which are more conspicuous from the center towards the anterior. From the center to the beak the shell is smooth except in the very large individuals where plications extend beyond the center becoming less conspicuous posteriorly. Very faint concentric lines of growth mark both valves. There is no distinct fold or sinus on either valve. Internally the dental lamellæ converge to form a triangular-shaped cavity which forms a continuation from the triangular delthyrium beneath the beak of the ventral valve. A central septum extends from the beak of the ventral valve more than two-thirds the length of the shell almost to the front. In its posterior portion the central septum is united to the converging dental lamellæ beneath the triangular aperture, formed by the delthyrium and the dental lamellæ. The dorsal interior not seen. Dimensions vary from small individuals 11 mm. long and 10 mm. wide to individuals 26 mm. long and 25 mm. wide.

Mature individuals of this variety are distinguished from those of *Gypidula coeymanensis* by the truncated anterior margin, less inflated beak of the ventral valve which is only slightly incurved over the beak of the brachial valve, by the feebly developed sinus and fold, rather indistinct plications and small size. The adult forms of this variety resemble more or less closely some of the immature shells of *G. coeymanensis*. This variety abounds in a zone a few feet thick near the middle of the Keyser member at most localities at which its horizon is exposed. It is hence

one of the most valuable faunal subzones of that member for the correlation of the various sections of the State.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Pinto, Devil's Backbone, Corriganville, Cash Valley, Market Street Bridge Cumberland, Breakneck Hill, $1\frac{3}{4}$ miles northeast of Flintstone, Flintstone, Hancock, Hazen, Maryland; Keyser, West Virginia; Hyndman, Pennsylvania.

*Collection.*—Maryland Geological Survey.

GYPIDULA (SIEBERELLA) COEYMANENSIS VAR. CORRIGANENSIS n. var.

Plate LXII, Figs. 12-18

*Description.*—Shell somewhat transversely subelliptical in outline, wider than long. Ventral valve convex, gibbous, greatest convexity about two-thirds the distance from the front to the beak; beak incurved over that of the opposite valve. The median portion of the valve is elevated in some individuals to form a fairly well-defined fold which extends from a short distance anterior to the umbo to the front, and contains several inconspicuous plications, while in other individuals the fold is very faint. On each side of the median fold there are two to three simple plications which are most prominent at the front and become obsolete from the center of the shell to the beak, leaving this portion of the shell smooth. Dorsal valve transversely subelliptical in outline, convex, greatest convexity just anterior to the umbo; much less convex than the ventral valve. It possesses a more or less depressed mesial sinus which never extends posterior to the center of the shell, and which is bounded by two rounded plications. One or two plications occur on each side of the sinus. Both valves are marked by inconspicuous concentric lines of growth. Dimensions: 17 mm. long and 19 mm. wide.

This species closely resembles *Gypidula angulata* Weller from the Coeymans of New Jersey from which it differs as follows: The median portion of the shell is elevated into a fold which is rarely sharply defined

and seldom extends farther than the center of the shell. The plications on the fold are rounded, never subangular. More than one plication occurs on each side of the fold and sinus.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Maryland; Keyser, West Virginia.

*Collection.*—U. S. National Museum.

### GYPIDULA SUBGLOBOSA n. sp.

Plate LXII, Figs. 20-22

*Description.*—Shell subglobose, both valves of almost equal convexity; length and breadth about equal. Ventral valve convex, gibbous, becoming ventricose in the umbonal region; beak prominent, slightly incurved opposite the beak of the dorsal valve. Dorsal valve of almost equal convexity with the ventral valve, gibbous in the umbonal region but not ventricose; beak slightly incurved and opposite the beak of the ventral valve. Two simple rounded plications form an undefined fold in the ventral valve which is only conspicuous from the center of the valve to the front, and a single plication on the brachial valve marks the center of an undefined sinus, bordered by two inconspicuous plications near the front. The shell is smooth on both valves from the center posteriorly. The slope from the umbonal regions is abrupt towards the posterior and the posterior region becomes concave; the lateral margins rounded. The shell is marked by faint concentric lines of growth. Dimensions of an average individual: Length 12 mm.; width 13 mm.

This species is distinguished from *Gypidula corriganensis* by its somewhat more globose character, the almost equal convexity of the valves, and by the prominent beaks which are almost equal and directly opposite each other, and by the abrupt slope from the umbonal region to the posterior.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley.

*Collection.*—U. S. National Museum.

## Order TELOTREMATA

### Superfamily RHYNCHONELLACEA

### Family RHYNCHONELLIDAE

Genus STENOCHISMA Conrad

STENOCHISMA FORMOSA (Hall)

Plate LXII, Figs. 25-29

*Rhynchonella formosa* Hall, 1859, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 76, figs. 1-5.

*Rhynchonella formosa* Hall, 1859, Pal. N. Y., vol. iii, p. 236, pl. xxxv, figs. 6*a-y*, 1861.

*Rhynchotrema formosum* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 369.

*Description.*—"Shell subtriangular or transversely oval; lateral margins forming an angle at the beak of about 90° to 110°. Ventral valve somewhat more depressed than the opposite: beak prominent, arched, not strongly incurved. Dorsal valve larger, declining with a gentle curve towards the margins: beak incurved. Surface marked by twenty to twenty-four simple angular plications on each valve, from two to four of which in the middle are coarser and depressed in the ventral valve, having a corresponding number abruptly elevated upon the dorsal valve; concentrically marked by fine closely arranged striæ." Hall, 1859.

The specimens referred to this species differ but little from those referred to *S. deckerensis,* the chief distinguishing feature being the more transverse form of the latter species.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Miller's Spring, Viaduct and Market Street Bridge Cumberland, Cash Valley, 1¾ miles northeast of Flintstone, Pinto, Flintstone, Maryland; Hyndman, Pennsylvania.

*Collection.*—Maryland Geological Survey.

STENOCHISMA DECKERENSIS (Weller)

Plate LXIII, Figs. 1-4

*Rhynchonella deckerensis* Weller, 1903, Geol. Survey, N. J., Pal., vol. iii, p. 234, pl. xxi, figs. 1-4.

*Description.*—"Shell subtriangular, wider than long, the postero-lateral margins sloping from the beak, where they form an angle of from 95°-115°, in nearly straight lines to a point a little posterior to the middle of the shell; the lateral and front margins regularly rounded. The pedicle valve usually a little less convex than the opposite one; its beak prominent, arched, but not strongly incurved; the sinus is rather abrupt, not reaching quite to the beak. The surface of the brachial valve curves gently to the margins, except toward the front, where the mesial fold is rather abruptly elevated. The surface of each valve is marked by from 20-24 simple, angular plications, of which two or three, somewhat coarser than the remainder, are depressed in the medial sinus, with a corresponding number elevated in the fold of the brachial valve.

"The dimensions of a rather large specimen are: Length 15 mm.; width 19.5 mm.; thickness 10 mm.

"This shell is a rather common one in the lower beds of the Decker Ferry formation. It resembles *Stenochisma formosa* Hall, from the higher portion of the Helderbergian series, but may be distinguished from that species by its coarser plications, its greater proportional width and by its less strongly convex valves, which gives to members of this species a less thickness of shell." Weller, 1903.

This species differs but little from *S. formosa* of which it may be considered a variety.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley, National Road east side of Warrior Mountain, Devil's Backbone, Corriganville, Maryland; Keyser, West Virginia; Hyndman, Pennsylvania.

*Collection.*—Maryland Geological Survey.

### Genus CAMAROTŒCHIA Hall and Clarke

### CAMAROTŒCHIA (?) LAMELLATA (Hall)

Plate LXIII, Figs. 9, 10

*Atrypa lamellata* Hall, 1852, Nat. Hist. N. Y., Pal., vol. ii, p. 329, pl. lxxiv, figs. 11*a-h*.

*Rhynchonella* (?) *lamellata* Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 359.

*Description.*—"Subrhomboidal, the ventral valve more convex; beak of the dorsal valve incurved, small, acute and prominent; surface marked

by six or seven plications on each side of the mesial lobe and sinus, which are simple from their origin; mesial sinus marked by two plications, with three corresponding ones on the opposite valve (rarely three plications in the sinus, and four on the corresponding elevation); plications crossed by strong imbricating lamellæ, which are deeply arched, giving the surface a rugose aspect. This species bears a close resemblance to *Atrypa rugosa;* but all the specimens examined are nearly uniform in size, and not so large as the larger ones of that species. The plications are also simple from their origin, though marked by imbricating lamellæ much in the same manner." Hall, 1852.

The shell is often subcircular in outline. In nearly all individuals seen in Maryland the mesial elevation is formed by two plications which coalesce towards the beak, one plication is found in the mesial sinus and three to four plications on each side of the sinus and fold. It has been established that no spirals occur in these shells, hence Schuchert removes this species from among the Atrypas. Its generic position is not assured. This species is abundant in the Tonoloway of Maryland.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Pinto, Market Street Bridge and Viaduct Cumberland, Cash Valley.

*Collection.*—Maryland Geological Survey.

### CAMAROTŒCHIA LITCHFIELDENSIS (Schuchert)

Plate LXIII, Figs. 11-14

*Atrypa* sp. Hall, 1852, Nat. Hist. N. Y., Pal., vol. ii, p. 330, pl. lxxiv, figs. 3 and 12.

*Rhynchonella agglomerata* Weller, 1903, Geol. Survey N. J., Pal., vol. iii, pp. 234-235, pl. xxi, figs. 5-11.

*Rhynchonella* (?) *litchfieldensis* Schuchert, 1903, Amer. Geol., vol. xxi, p. 167, figs.

*Description.*—"Shell subtriangular, usually a little wider than long, the valves subequally convex, the postero-lateral margins tapering to the beak, where they form an angle of about 90°; the lateral and anterior margins rounded. Pedicle valve most prominent near the umbo, the beak sharply pointed, arched over that of the opposite valve; mesial sinus rather shallow, rounded in the bottom, not extending back to the center

of the valve. Brachial valve most prominent at and in front of the middle; mesial fold not conspicuous, except near the front margin. Each valve marked by from eighteen to twenty-two simple, angular plications, three of which are usually included in the sinus of the pedicle valve. The finer markings of the shell, if they were present, have been obliterated by exfoliation. The dimensions of an average adult specimen are: Length 9 mm.; width 9.5 mm., and thickness 5.5 mm." Weller, 1903.

This small shell is very abundant in the *Chonetes jerseyensis zone* of the Keyser member. It is distinguished from *Rhynchonella transversa* of the Helderberg by its smaller size, and by the fact that the fold and sinus are not so broad except in the larger specimens.[1] It is also more gibbous and less transverse. *Camarotœchia litchfieldensis* also resembles *Rhynchonella neglecta* from the Clinton and Niagara faunas. It differs from *R. neglecta* in having more plications with the fold and sinus narrower only in the small individuals, the sinus and fold broadening in the larger forms. This form, which has been found in the Cobleskill of New York, has been identified as *R. neglecta,* so closely does it resemble it.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. At all exposures of the *Chonetes jerseyensis zone.*

*Collection.*—Maryland Geological Survey.

### CAMAROTŒCHIA GIGANTEA n. sp.

Plate LXIII, Figs. 15, 16

*Description.*—Shell subtriangular in outline. Width greater than the length. Pedicle valve convex, greatest convexity in the umbonal region, anterior to this somewhat depressed convex, beak closely incurved over that of the dorsal valve. Sinus shallow and undefined posteriorly, becoming deeper and with more definite limits towards the front. Dorsal valve larger than the ventral valve, extremely gibbous, greatest convexity two-thirds the distance from the beak to the anterior, sloping gradually to the beak and abruptly to the anterior and lateral margins. No well-de-

[1] The individual figured by Schuchert in American Geologist, vol. xxi, p. 167, 1903, is much enlarged, although no mention is made of that fact.

veloped mesial fold; beak strongly incurved under that of the ventral valve. Surface marked by simple, well-defined, round, radiating plications, which are more elevated and prominent towards the anterior and though not becoming obsolete they are not so prominent in the umbonal region. About 18 to 20 plications on each valve, five of which may occupy the sinus on the ventral valve. The dorsal margins are abruptly deflected posteriorly and become rounded towards the front.

This form resembles most closely *Camarotœchia stricklandi* (Sowerby) of the Niagara. It is of about the same size, but differs in having the plications of equal size upon the sides and in the mesial sinus. Sinus narrower, no prominent mesial fold. The reference of this species to the genus Camarotœchia is not assured as the interior of the shell has not been observed.

Length about 2.5 cm.; width about 3 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Cash Valley.

*Collections.*—Maryland Geological Survey, U. S. National Museum.

### Genus UNCINULUS Bayle

### UNCINULUS NUCLEOLATUS VAR. ANGULATUS n. var.

Plate LXIV, Figs. 18-20

*Description.*—Shell subpentagonal in outline, width more than two-thirds the length. Ventral valve convex, not at all gibbous, approaching more to plano-convex; beak sharp, pointed, but slightly incurved and extending beyond that of the dorsal valve. Dorsal valve convex, larger than the ventral valve; beak slightly incurved beneath that of the ventral valve, lateral margins abruptly deflected. Both valves have about equal convexity and are slightly deflected toward the lateral margins, the dorsal valve being more convex is more abruptly deflected toward the lateral margins; both valves gently curved in front. Surface marked by 23 well-developed simple plications in addition to which there are several indistinct plications near the lateral margins. The plications are very prominent from the center towards the front, becoming obsolete towards the beak.

Four plications form a slight elevation on the dorsal valve and three occupy a shallow sinus on the ventral valve. The sinus is produced in front to form a slight linguiform extension. Dimensions: Length 12.5 mm.; width 9.5 mm.

This species closely resembles *Uncinulus nucleolatus* (Hall) from which it differs in having more angular plications which are more prominent towards the front and become obsolete toward the beak. The valves are also less convex than those of that species.

This form is in the material collected by Rowe and referred by him to the Helderberg.

*Occurrence.*—HELDERBERG FORMATION? KEYSER MEMBER? Cumberland.

*Collection.*—Maryland Geological Survey.

### UNCINULUS GORDONI n. sp.

Plate LXV, Figs. 1-6

*Description.*—Shell subpentagonal, length and breadth about equal. Ventral valve convex, sometimes slightly depressed convex; beak small, extending beyond and usually slightly incurved over that of the opposite valve. Dorsal valve convex, larger than the ventral valve, at times gibbous. Beak small, incurved under the beak of the ventral valve, more incurved in the more gibbous individuals. Surface marked by simple subangular plications, varying in number from 19 to 26, which extend to the beak; more prominent in front, becoming less conspicuous towards the beak. In some individuals three or four plications form a slight mesial elevation at the anterior portion of the dorsal valve, while two or three plications occupy a shallow sinus in the ventral valve. The sinus and fold become almost obsolete in some individuals at the anterior margin. The lateral margins are deflected somewhat abruptly posteriorly. Dimensions of a small individual: Length 8 mm.; width 7.5 mm. Large individual: Length 12.5 mm.; width 12 mm.

This form approaches most closely *Uncinulus nucleolatus* (Hall) and Professor Schuchert has suggested that it may be a young form of that species. It differs from *Uncinulus nucleolatus* in being smaller, the beak

of the ventral valve is straighter and not so closely incurved over that of the dorsal valve. It has in some individuals more plications and the plications are more angular than in *Uncinulus nucleolatus*. In the anterior portion the sinus and fold when present are less distinct and the fold is not prolonged anteriorly to form the linguiform extension seen in *Uncinulus nucleolatus*.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley.

*Collection.*—U. S. National Museum.

### UNCINULUS CONVEXORUS n. sp.

Plate LXV, Figs. 9-14

*Description.*—Shell trigonal or somewhat pentagonal, width at least two-thirds the length. Ventral valve convex, abruptly deflected in front. Beak prominent, pointed, in some forms straight, but in most forms slightly incurved over that of the dorsal valve. Dorsal valve much more convex than the ventral valve, abruptly deflected in front and towards the lateral margins; beak incurved beneath that of the ventral valve. Surface marked by thirty or more low, simple, rounded plications, which become indistinct and are almost obsolete near the beak and are faint near the lateral margins. The lateral margins are slightly inflected so that the sides become distinctly concave. Fold and sinus very faint or absent entirely. The anterior portion is rounded. The plications and depressions interlock to produce sharply serrated lateral and front margins of contact. Dimensions of an average individual: 18 mm. long, and 15.5 mm. wide.

This form most closely resembles *Uncinulus campbellanus* of the Helderberg. In the latter species the dorsal valve is elevated near the front into a broad undefined mesial fold, the ventral valve is compressed and a broad sinus occupies the entire width of the narrow front, the front margin curves upward and extends into a subtriangular prolongation.

In *Uncinulus convexorus* the dorsal valve is not elevated near the front and there is no distinct mesial fold; the ventral valve is plano-convex. There is an undefined sinus in some individuals while most individuals have no sinus, and the front margin is rounded and sharply serrated. On

account of the characteristic rounded margins the name *Uncinulus convexorus* has been applied to it.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Tonoloway, Cash Valley, Viaduct Cumberland, Cookerly, Pinto, Maryland; near Cherry Run, Keyser, West Virginia; Hyndman, Pennsylvania.

*Collections.*—Maryland Geological Survey, U. S. National Museum.

### Genus WILSONIA Kayser

### WILSONIA GLOBOSA Weller

Plate LXV, Figs. 15-17

***Wilsonia globosa*** **Weller, 1903, Geol. Survey N. J., Pal., vol. iii, p. 235, pl. xxi, figs. 12-22.**

*Description.*—"Shell subglobose, a little longer than wide. Pedicle valve less convex than the brachial, its beak suberect or slightly arched, acutely pointed, umbo smooth and convex, mesial sinus shallow, beginning near the middle of the valve and produced as a lingual extension in front, at nearly a right angle to the plane of the valve. Brachial valve strongly convex or gibbous, smooth posteriorly, anterior margin deeply sinuate, mesial fold slightly elevated, originating near the middle of the valve. The surface of each valve is marked by sixteen or eighteen simple, low, rounded plications, sometimes slightly grooved anteriorly and becoming nearly or quite obsolete posteriorly, leaving that portion of both valves smooth. From two to five plications are included within the sinus, the more common number being four, with a corresponding number in the fold of the opposite valve. The dimensions of a rather large globose individual are: Length 12 mm.; width 11 mm.; thickness 10 mm. Those of another less globose specimen are: Length 11.25 mm.; width 10.5 mm.; thickness 7.5 mm.

"In some of its characters this species resembles the Helderbergian forms *Uncinulus mutabilis* Hall and *U. nucleolatus* Hall. It differs from both of them, however, in its smaller size, and in the obsolescence of its plications on the posterior portions of the shell. Internally there are conspicuous differences which are of even generic value. In *Wilsonia globosa* the cardinal process is absent, the hinge-plate is divided and is

supported by a strong median septum. These characters, when associated with its external form, place it in the genus *Wilsonia,* while the two Helderbergian species mentioned possess well-developed cardinal processes and the other characters which distinguish the genus *Uncinulus.*" Weller, 1903.

It occurs in the upper Decker Ferry of New Jersey.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cumberland, Cash Valley.

*Collection.*—U. S. National Museum.

### WILSONIA CF. GLOBOSA Weller

Plate LXV, Figs. 18-20

*Description.*—Shell transversely subelliptical to subpentagonal in outline, broader than long. Ventral valve convex, plano-convex to depressed convex; beak extending beyond that of the brachial valve and slightly incurved over it. Dorsal valve convex, more gibbous and consequently more convex than the ventral valve, greatest convexity near the middle, beak incurved under the beak of the ventral valve. Surface of each valve contains indistinct, low, rounded, simple radiating plications, which can only be seen from the center anteriorly and become more conspicuous towards the front. From the center of the shell to the beak the surface is smooth save for indistinct concentric lines of growth. Anterior slope abrupt; lateral margins abruptly deflected posteriorly and rounded towards the anterior margin. Fold and sinus scarcely if at all developed.

Dimensions, 11 mm. long and 13.5 mm. wide.

A single somewhat imperfect individual has been observed which has been described above. It may be compared with *W. globosa* from which it differs in a number of respects.

*Occurrence.*—HELDERBERG FORMATION? KEYSER MEMBER? Tonoloway.

*Collection.*—Maryland Geological Survey.

## Superfamily SPIRIFERACEA

### Family ATRYPIDAE

#### Genus ATRYPA Dalman

#### ATRYPA RECTICULARIS (Linné) [1]

Plate LXVII, Figs. 26-28

*Anomia reticularis* Linné, 1767, Systema Naturæ, ed. xii, tome i, p. 1132.
*Atrypa reticularis* Hall, 1852, Nat. Hist. N. Y., Pal., vol. ii, p. 72, pl. xxiii, fig. 8; p. 270, pl. lv, fig. 5.

*Description.*—" Shell subrotund, more or less compressed, subtruncated above or on the hinge-line; valves more or less equal, the beak of the dorsal valve extending beyond the ventral valve, and the latter being deeper and more convex in older specimens; surface marked by dichotomous rounded striæ, which are crossed by concentric elevated lamellæ, giving a reticulated or decussated character to the surface. It is impossible to give a definite description of this very protean species, which commences its existence in the Clinton group and continues with various modifications as far as the Chemung. In each of its geological positions, however, it presents peculiar characters and we are able to decide at once the geological position of specimens by these peculiarities. On its first appearance in the Clinton group, it shows its variable character in a remarkable degree, and it is scarcely possible to avoid referring the individuals to distinct species. In many of the young specimens the ventral valve is nearly flat, or slightly convex, with a depression along the center from beak to base. In specimens of medium size the valves are nearly equal and in older ones the ventral valve is the more convex. Again there are others where, in the young shell the ventral valve has no depression in the center, and is equally convex with the dorsal valve. In the radiating striæ or plications it is equally variable; many specimens having them very distinctly dichotomous, while others are nearly undivided from the beak. In many young

[1] For figures of the Upper Silurian and Lower Devonian variation see Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, pl. xlii, figs. 1*a-r*. For a complete American bibliography and synonymy see Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, pp. 154-155.

shells the concentric striæ leave the plications nodulose at their crossing; while there are specimens having the plications quite free from such characters, and entirely smooth." Hall, 1852.

This ubiquitous brachiopod is a common fossil of the Silurian and Devonian systems in Maryland.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Tonoloway. COEYMANS MEMBER. Dawson, Devil's Backbone, Maryland; Keyser, West Virginia. NEW SCOTLAND MEMBER. Devil's Backbone, Miller's Spring near Cumberland. ORISKANY FORMATION, RIDGELY MEMBER. Cumberland.

*Collection.*—Maryland Geological Survey.

### ATRYPA ? BICONVEXA n. sp.

Plate LXVIII, Figs. 1-3

*Description.*—Shell subcircular in outline, wider than long; lateral, cardinal, and anterior margins rounded. Valves of almost equal convexity. Ventral valve convex, greatest convexity along the median portion of the valve, the anterior portion abruptly deflected; beak incurved, pointed. Dorsal valve convex, though not quite as convex in the median portion as the ventral valve, the convexity being uniform, greatest convexity about one-third the distance from the beak towards the anterior; beak small, pointed, not prominent and only slightly incurved. The anterior margin is abruptly inflected to correspond to the abrupt deflection of the anterior margin of the ventral valve. Surface marked by eight simple rounded plications on each valve which radiate from the beak and which are more prominent along and near the median portion of both valves. In the ventral valve the three medial plications form an undefined mesial elevation. There is, however, no indication of a sinus on the brachial valve. Both valves are marked by well-defined concentric imbricating lamellæ which give to the shell a distinctly rugose appearance.

Dimensions: 13 mm. long and 16 mm. wide.

This shell most closely resembles *Atrypa rugosa* of the Niagara. It is not as convex as that species, the plications are not as numerous and do not bifurcate, and it has no marked mesial depression on the dorsal valve.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia; Cash Valley, Maryland.

*Collection.*—U. S. National Museum.

## Family SPIRIFERIDAE

### Genus SPIRIFER Sowerby

### SPIRIFER MODESTUS Hall

Plate LXVIII, Figs. 17-22

*Spirifer modestus* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 203, pl. xxviii, figs. 1*a-e*, 1861.

*Description.*—"Shell small, subglobose. Ventral valve very gibbous near the middle and towards the beak, having a shallow undefined sinus extending from the beak to the front: beak prominent, acutely pointed, incurved. Dorsal valve regularly convex, semicircular or subtriangular: extremities rounded, sometimes an undefined mesial elevation: beak scarcely extending above the hinge-line, not incurved; hinge-line very short, rounded at the cardinal extremities. Area triangular, faintly defined, about half the width of the shell, arcuate. Foramen of medium size, narrow, triangular. Dental lamellæ slightly diverging, and extending more than half way to the base of the shell. Surface marked by faint concentric lines of growth." Hall, 1859.

This species was described by Hall from specimens found at Cumberland. As found in the Keyser of Maryland it corresponds to *Spirifer corallinensis* the typical spirifer of the New York Cobleskill. There is a close relationship between these two forms. *Spirifer modestus* differs chiefly from *Spirifer corallinensis* in its extremely shallow sinus and faint fold, and in the absence of distinct plications. It is also closely related to *Spirifer eriensis* from which it differs in having its beak much curved, cardinal slopes quite concave, greatest width two-thirds the distance from the front, cardinal angles rounded, and in being without plications.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Market Street Bridge Cumberland, southwest of Rawlings, Pinto, Cash Valley,

Devil's Backbone, Tonoloway, Flintstone, Hancock, Breakneck Hill Allegany County, Maryland; Hyndman, Pennsylvania; Cedar Cliff, Knobly Mountain, Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

### SPIRIFER MODESTUS VAR. PLICATUS n. var.

Plate LXVIII, Figs. 23, 24

*Description.*—Shell large in comparison with the typical form of *S. modestus;* subglobose, somewhat transverse. Ventral valve very gibbous toward the beak, greatest convexity about two-thirds the distance from front to beak. Sinus usually well defined, extending from the beak to the front; beak prominent, pointed and incurved. Dorsal valve regularly convex, gibbous, greatest convexity just anterior to the beak; beak incurved scarcely extending above the hinge-line; extremities of the shell rounded and with a well-defined mesial elevation. Area triangular, faintly defined, about one-half the width of the shell. Surface marked by three or four indistinct plications on each side of the fold and sinus, and by faint concentric lines of growth.

Length 1.5 cm.; width 1.8 cm.

This variety differs from the typical form in having a well-developed sinus and mesial fold and much more pronounced plications.

It also resembles *S. vanuxemi* var. *prognosticus,* but differs from the latter in its much greater size and absence of spiniferous surface.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

### SPIRIFER OCTOCOSTATUS Hall

Plate LXVIII, Figs. 25-29

*Spirifer octocostatus* Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 62.

*Spirifer octocostatus* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 205, pl. xxviii, figs. 4*a-e*, 1861.

*Description.*—"Shell subglobose: valves nearly equally convex. Ventral valve most elevated near the beak: sinus angular, extending to the

apex: beak slightly incurved. Dorsal valve most convex in the middle: mesial elevation not prominent: beak rising little above the hinge-line, slightly incurved; hinge-line less than the width of the shell, rounded at the extremities. Area triangular, faintly defined, somewhat arcuate. Foramen narrow; a strong median septum dividing the muscular area, and extending to the apex of the foramen. Surface having about four rounded moderately prominent folds on each side of the mesial sinus and elevation, which become obsolete towards the beaks; concentrically marked by fine, regular, closely arranged imbricating lamellose striæ." Hall, 1859.

Length 1.5 cm.; width 2.2 cm.

The species Weller describes as *Spirifer octocostatus* in the Coeymans of New Jersey [1] is not well preserved, and it is probable that he had another form.

At Cash Valley and the section 1¾ miles northeast of Flintstone and at Hyndman, Pennsylvania, there is a species which has been identified as *Spirifer octocostatus*. It differs from the normal *S. octocostatus* in having the folds more angular and more elevated and they diverge more rapidly from the beak, with the sinus deeper. The beak is not so much incurved.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Cash Valley, Cumberland, Pinto, 1¾ miles northeast of Flintstone, Maryland; Hyndman, Pennsylvania; Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

### SPIRIFER VANUXEMI Hall

Plate LXVIII, Figs. 32, 33

*Spirifer vanuxemi* Hall, 1859, Nat. Hist. N. Y. Pal., vol. iii, p. 198, pl. viii, figs. 17-23, 1861.

*Description.*—"Shell rhomboidal, moderately gibbous: extremities rounded. Ventral valve the less convex, having the beak elevated and incurved. Area small. Surface marked by broad rounded or somewhat flattened and sometimes undefined plications, of which there are from two to four on each side of the mesial fold and sinus; concentrically marked by

[1] Geol. Survey N. J., Pal., vol. iii, 1903, p. 288, pl. xxx, figs. 5-8.

fine closely arranged undulating striæ and stronger imbricating lines of growth, which are again crossed by still finer radiating striæ; the latter visible only under a magnifier." Hall, 1859.

The individuals referred to this species in Maryland differ somewhat from the typical *S. vanuxemi* of the Manlius of New York in their expression, although the differences hardly justify a distinct varietal name. They appear to be confined to the *Chonetes jerseyensis zone.*

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone beneath the Gypidula zone, Cash Valley, 1¾ miles northeast of Flintstone, Roundtop.

*Collections.*—Maryland Geological Survey, U. S. National Museum.

### SPIRIFER ERIENSIS Grabau

Plate LXIX, Fig. 7

*Spirifer eriensis* Grabau, 1900, Bull. Geol. Soc. Amer., vol. xi, pp. 366-367, pl. xxi, figs. 2*a-b*.

*Description.*—"Shell small, pedicle valve strongly convex, almost ventricose, subrhomboidal in outline, with the beak much elevated and gently incurved. Mesial sinus pronounced; angular in the center, with the sides nearly flat, gradually and uniformly increasing in width from the beak forward. Sometimes it is slightly rounded in the bottom. It is prolonged at the front of the shell as a prominent rounded lip. On either side of the sinus is a moderately strong, broadly rounded, but not very prominent plication, in addition to which there are about three or four on either side, which are fainter and progressively become narrower away from the sinus. Interspaces narrow, having the form of a depressed line, the broadest next to the plication adjoining the sinus. Brachial valve almost semicircular, moderately convex, with a straight hinge-line, which is shorter than the greatest width of the valve. Beak elevated above the hinge-line and incurved. Fold distinctly defined by a sharp depressed line on either side, but not elevated much above the general surface of the valve. It gradually and uniformly widens forward, is broadly rounded on top, and is occasionally marked by a slight central depression. Ribs almost obsolete, a faint depression outlining the first on either side of the fold in some

specimens. Surfaces of both valves marked by fine, uniform, and subequally spaced concentric lines which curve forward in the sinus of the pedicle valve. Occasionally strong lines mark a temporary resting stage during growth. The whole surface appears to be covered with fine radiating striæ, which are interrupted by the concentric striæ, thus giving the surface a fimbriate appearance. On the interior of the pedicle valve are two short dental plates, diverging slightly more than the sides of the sinus. The cardinal area of this species is high, occupying in some specimens as much as a third of the total height of the valve. The strength of the ribs on the brachial valve varies somewhat in different specimens, but they are always much less marked than those of the pedicle valve, and they are usually quite obsolete.

"The species to which this most nearly approaches is the variety of *S. crispus* Hisinger found in the Coralline limestone at Schoharie. In this variety the ribs are much fainter than in the normal *S. crispus* of the Niagara shales and limestones of western New York. In many specimens from Schoharie the ribs are almost obsolete, comparing well with their character in *S. eriensis*. The sinus of the Schoharie specimens is subangular, and the fold flattened much as in the Bullhead limestone species. This variety is also proportionally higher than the normal form, giving a subrhomboidal outline to the pedicle valve, which strongly recalls *S. eriensis*. In general the ribs of this latter species are slightly broader and rather more flattened on top than is the case in the Coralline limestone species, and the interspaces are somewhat narrower. Taking all the variations into consideration, a very close relation must be accepted as existing between the two species. The specimens described by Whitfield as *S. vanuxemi* from the hydraulic limestone (Manlius?) of Peach Point, Put-in-Bay, Lake Erie, resembles rather more closely the normal *S. crispus* than it does the typical *S. vanuxemi* of the Manlius limestone of central New York. The similarity to the Niagaran species was observed by Whitfield. The strong plications and greater width separate it from *S. eriensis*.

"Most of the specimens of *S. eriensis* were found at Williamsville. A few, however, came from the cement quarries in north Buffalo. Width of the pedicle valve illustrated, 10 mm.; length, 8.5 mm. Width of the brachial valve illustrated, 7.5 mm.; length, 6 mm." Grabau, 1900.

Only one specimen has been found in Maryland in the Cash Valley section associated with *Dalmanella clarki*. *S. eriensis* is very closely related to *S. modestus* and *S. plicatus* of Maryland. It may be distinguished from the former by its larger size and plications, and from the latter which it so closely resembles by its less incurved beak, greatest width near middle of valve, acute cardinal angles of brachial valve.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley.

*Collection.*—Maryland Geological Survey.

### Genus RETICULARIA McCoy

### RETICULARIA BICOSTATA (Vanuxem)

Plate LXXII, Figs. 8-10

*Orthis bicostatus* Vanuxem, 1842, Geol. N. Y., Third Dist., pp. 91-94.
*Spirifer bicostatus* Hall, 1852, Nat. Hist. N. Y., Pal., vol. ii, p. 263, pl. liv, fig. 4.
*Spirifera bicostata* Hall, 1883, 2d Ann. Rept. N. Y. State Geol., pl. lxi, fig. 7.
*Spirifer bicostatus* Hall and Clarke, 1893, Pal. N. Y., vol. viii, pt. ii, pp. 19, 37, pl. xxxvi, fig. 7.

*Description.*—"Somewhat ovate triangular, the dorsal valve gibbous, with the beak extended and incurved over a short triangular area; ventral valve convex; surface marked by conspicuous concentric subimbricating striæ; dorsal valve with a distinct plication on each side of the sinus, and toward the base are two other obscure plications on each side, presenting three and sometimes four gentle undulations on the margin on each side of the center; cardinal line shorter than the width of the shell, and the area scarcely extending so far as the cardinal line; extremities distinctly rounded." Hall, 1852.

The forms found are all small. The ovate triangular outline, conspicuous concentric subimbricating striæ, and plications distinguish it from *Spirifer modestus*. It differs from *Spirifer crispus* of the Niagara in its fewer and less marked plications.

Length 13 mm.; width 14 mm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Roundtop.[1]

*Collection.*—Maryland Geological Survey.

[1] It is possible that this species is from the Tonoloway formation.

## Family RHYNCHOSPIRIDAE

### Genus RHYNCHOSPIRA Hall

### RHYNCHOSPIRA FORMOSA Hall

Plate LXXII, Figs. 26-30

*Waldheimia formosa* Hall, 1857, 10th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 88.

*Trematospira formosa* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 215, pl. xxxvi, figs. 2*a-t*, 1861.

*Rhynchospira formosa* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 485, pl. xcv*a*, figs. 7-11, 1861.

*Description.*—"Shell longitudinally ovate. Ventral valve tapering towards the beak: beak prominent, rounded, arched or incurved, truncated at the apex by a round perforation, one side of which is formed by the deltidium. Dorsal valve gibbous, sometimes most prominent near the umbo: beak closely incurved beneath the opposite one. Surface marked by eighteen to twenty-two or twenty-three simple rounded or rarely subangular plications, two or three of which are much smaller and slightly depressed on the middle of each valve, so as to form a faint narrow sinus extending nearly or quite to the apex of the beaks, and giving a slight emarginate outline to the front. Surface marked by fine imbricating concentric lines of growth, which become strong lamellæ towards the margins of the shell: shell granulose." Hall, 1859.

Length 1.5 cm.; width 1.4 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Cash Valley, Tonoloway, Cookerly, ¼ mile east of Rush, Maryland; Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

### Genus NUCLEOSPIRA Hall

### NUCLEOSPIRA SWARTZI n. sp.

Plate LXXIII, Figs. 15-17

*Description.*—Shell subcircular to transversely subelliptical in outline, subglobose. Breadth greater than length. Cardinal, lateral, and anterior margins rounded. Hinge-line shorter than the greatest width of the shell.

Ventral valve convex, gibbous, greatest convexity about one-third the distance from the beak to the front; beak pointed and prominent, strongly incurved over that of the dorsal valve. In some individuals there is a faint undefined shallow sinus which may extend from the beak to the front, producing at the front a slightly emarginate appearance. Dorsal valve convex, less so than the ventral valve, approaching to depressed convex, point of greatest convexity about one-third the distance from the beak to the front; beak prominent and incurved under that of the ventral valve. Sometimes an indistinct mesial depression marks the anterior portion of this valve. Surface of both valves marked by indistinct concentric lines of growth which become more prominent towards the front where they become distinct concentric lamellæ.

This species is closely related to *N. elegans* from which it differs in being less transverse, its outline being more nearly subquadrate. It also differs in the lesser convexity and much less distinct sinus of brachial valve.

Dimensions: Large individuals 18 mm. wide, 16 mm. long.

It differs from *N. ventricosa* in being less globose, larger, the ventral valve much more convex than the brachial valve. The valves are of almost equal convexity in *Nucleospira ventricosa.*

Length 1.5 cm.; width 1.6 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cookerly, Devil's Backbone, Cash Valley, Maryland; Keyser, West Virginia.

*Collection.*—Maryland Geological Survey.

## Family MERISTELLIDAE

### Genus WHITFIELDELLA Hall and Clarke

### WHITFIELDELLA (?) PROSSERI Grabau

Plate LXXIII, Figs. 34-36

*Meristella lævis* Whitfield, 1891, Ann. N. Y. Acad. Sci., vol. v, p. 510, pl. v, figs. 6 and 7.

*Meristella lævis* Whitfield, 1895, Ohio Pal., vol. vii, p. 411, pl. i, figs. 6 and 7.

*Meristella lævis* Sherzer, 1900, Geol. Survey Mich., vol. vii, p. 223, pl. xvii, figs. 6 and 7.

*Whitfieldella* cf. *lævis* Grabau, 1900, Bull. Geol. Soc. Amer., vol. xi, p. 369, pl. xxii, figs. 4*a-d.*

*Whitfieldella prosseri* Grabau, 1910, Michigan Geol. Surv., Publication 2, Geological Ser. 1, p. 152, pl. xxi, figs. 3, 8, 9, 12-13; pl. xxx, figs. 6-7.

*Description.*—" Shell of medium size, elongate, with strongly convex smooth valves. Pedicle valve arcuate from beak to base, greatest convexity in the umbonal region. Beak curved to a 90° angle with the edge of the valve apparently truncated by a circular foramen. The center of the valve is marked by a median depression which begins a short distance below the beak and extending forward gradually broadens without much deepening. Near the anterior end this sinus is gently rounded, sometimes almost flat bottomed. On the anterior end the sinus is marked by a slight rounded projection. Surface marked by concentric striæ which at intervals in some specimens become strong wrinkles near the front.

" On the interior the deltidial margins are supported by delicate dental septæ. These arise from the bottom of the valve on either side of the center and at first are inclined outwards for about one-half their height and then turn rather abruptly upwards making a marked angle. Near the upper end they bend outward again to the margins of the delthyrium.

" At the lower angle a thin short plate springs outward and upward connecting the septum with the shell. This plate is marked in the internal mold by a pronounced slit, cutting the mold of the lateral rostral chambers. The aspect of the whole is that of a broad spondylium resting on the bottom of the valve and supported laterally by the secondary lamellæ. Anteriorly the dental lamellæ extend as low, slightly outward curving ridges, which between them enclose a longitudinally striated muscular area.

" Brachial valve subquadrangular, the width slightly greater than the height; somewhat less convex than the pedicle valve, and regularly arched without median fold. In some cases the faintest longitudinal depressions occur near the front, in the lateral third of the slope, thus giving a suggestion of a median fold. The beak projects slightly above the cardinal line, being incurved. The postero-lateral margins are more or less regular curves, the antero-lateral ones have their outline curved to a larger radius thus making the sinus appear rather truncate. The anterior margin is slightly emarginate corresponding to the projection of the pedicle valve. Surface marked by lines of growth and in some specimens by irregular wrinkles. On the interior a strong sharp septum extends from the beak

to something over one-third the distance to the front. Just below the beak it divides at the top, carrying a small but pronounced spondylium (cruralium). The sides of the spondylium curve out to the margin of the shell, joining it about one-half way between the elongate, narrow dental socket, and the beak.

"A characteristic pedicle valve measures: Length 25 mm.; height 20 mm.; greatest width 16.25 mm." Grabau, 1910.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cherry Run, West Virginia.

*Collection.*—Maryland Geological Survey.

### WHITFIELDELLA (?) NUCLEOLATA (Hall)

Plate LXXIII, Figs. 37-40

*Atrypa nucleolata* Hall, 1852, Nat. Hist. N. Y., Pal., vol. ii, p. 328, pl. lxxiv, fig. 10.

*Merista nucleolata* Hall, 1859, 12th Ann. Rept. N. Y. State Cab. Nat. Hist., p. 78.

*Meristella nucleolata* Whitfield, 1882, Geol. Wis., vol. iv, p. 321, pl. xxv, fig. 5.

*Description.*—"Shell round oval or oval ovoid; beak of the dorsal valve often much extended, and incurved over the ventral valve; surface concentrically striated; front of the shell indented, the indentation connected with a depression or groove down the center of the dorsal valve, and sometimes a similar one on the lower half of the ventral valve. This species approaches very closely the *A. nitida* of the Niagara group, but is less elongated, and the identation in front and the groove down the center of the dorsal valve are more conspicuous in the species from the Coralline limestone. There are sometimes, however, specimens which do not possess these characters, and the shell is then not easily distinguished from those in the Niagara group." Hall, 1852.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—Robert Gordon.

WHITFIELDELLA (?) MINUTA n. sp.

Plate LXXIII, Figs. 41, 42

*Description.*—Shell small to minute, elongated in a direction from beak to base, giving to the shell a somewhat subovate outline. Both valves strongly convex, gibbous to somewhat ventricose, lateral and antero-lateral margins regularly rounded, cardinal margins convex, but these curves are sharper than the curves of the anterior margin. Ventral valve the longer, convex, gibbous to subventricose. Greatest convexity just posterior to the middle of the valve. Beak slightly incurved, prominent, pointed, extending beyond that of the dorsal valve. Dorsal valve regularly convex, gibbous, greatest convexity in the umbonal region; beak pointed, incurved, filling the delthyrium of the ventral valve. Surface smooth or marked by very faint obscure concentric lines of growth and on exfoliated individuals fine silk-like striations radiate from the beak. No fold or sinus on either valve. In some individuals the anterior portion is prolonged into a modified linguiform extension, while in other individuals the anterior margin is rounded.

Size of largest individual 3 mm. long and 2 mm. wide.

This species is distinguished by its minute size. There is no fold or sinus on either valve.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Roundtop.

*Collection.*—Maryland Geological Survey.

# MOLLUSCA

## CLASS PELECYPODA

### Order PRONODESMACEA

#### Section PALAEOCONCHA

##### Family GRAMMYSIIDAE

Genus GRAMMYSIA Verneuil

GRAMMYSIA sp. ?

Plate LXXV, Fig. 1

*Description.*—An incomplete individual, evidently belonging to this genus has been found in the Keyser member. It is the only representative

of the genus that has been found in the state. The specimen being broken off just posterior to the beaks prevents determination but it probably is a new species.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## Family AMBONYCHIIDAE

### Genus AMPHICŒLIA Hall

### AMPHICŒLIA ULRICHI n. sp.

Plate LXXV, Figs. 8-10

*Description.*—Broadly triangular subovate in outline. Length and height about equal. Valves equal, somewhat gibbous from the center to the beaks, sloping abruptly to the anterior margin, while the decline from the most gibbous portion of the shell to the posterior and ventral margins is more gradual, giving to the shell a cuneiform profile. The cardinal line arcuate. Cardinal slopes concave in the vicinity of the beak in the casts. Anterior and posterior cardinal margins and ventral margin regularly rounded. In the posterior portion of the shell at the point of greatest length, the shell is extended making the form inequilateral. The umbones in the better preserved individuals are equal and opposite, broad and gibbous, and are curved inward and forward over the hinge-line and placed considerably anterior to the middle. Surface of both valves marked by moderately strong radiating costæ. The costæ are low, rounded, and simple, six or seven occupying the space of 5 mm. in the umbonal region, the costæ are indistinct toward the base in the individuals at hand, but the general appearance indicates that they become wider toward the base. Shell varying in size from small individuals to quite large ones for this genus.

This species most closely resembles *Amphicœlia costata* (Hall and Whitfield) of the Niagara of Ohio. It differs, however, in being less ventricose, the beaks are more nearly central, and the costæ are more numerous.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## Family PTERIIDAE

### Genus ACTINOPTERIA Hall

### ACTINOPTERIA RETICULATA Weller

Plate LXXVI, Fig. 6

*Actinopteria reticulata* Weller, 1903, Pal. N. J., vol. iii, p. 245, pl. xxii, fig. 3.

*Description.*—"Left valve large, subrhomboidal in outline; the body subovate, with an obliquity of 27° between the hinge-line and the umbonal ridge; beak but slightly elevated above the hinge-line. Anterior margin nearly straight or slightly sinuate, forming a rounded angle of about 80° with the hinge-line; basal margin regularly curved; posteriorly it rounds more abruptly into the nearly straight or slightly sinuate posterior margin which is nearly parallel with the anterior margin. Posterior wing large, slightly convex, limited below by a moderately distinct, rounded sinus; the posterior cardinal extremity obtuse. The body of the shell is marked by conspicuous, concentric lines of growth and by more or less discontinuous, radiating costæ. Near the margin of the shell the concentric lines are more crowded and the radiating costæ are less conspicuous, but on the upper portion of the shell the two sets of markings give to the surface a nodose appearance. The posterior wing is marked like the body of the shell, but the radiating markings are much less conspicuous. Right valve unknown.

"The dimensions of the type specimen are: Height 35 mm.; oblique length from beak to postero-basal extremity 48 mm.; length of hinge-line 29 mm." Weller, 1903.

The individual specimen at hand is badly broken and consists of only one valve. The general character of the shell agrees with this species and the body of the shell is marked by conspicuous concentric lines of growth and by more or less discontinuous radiating costæ. There is little doubt as to the identification, although the individual is only in part preserved.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## Section ISODONTA

### Family PECTINIDAE

#### Genus AVICULOPECTEN McCoy

#### AVICULOPECTEN TENUILAMELLATUS (Hall)

Plate LXXVIII, Fig. 4

*Avicula tenuilamellata* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 281, pl. li, figs. 1 and 2, 1861.

*Description.*—"Shell orbicularly subovate: left valve scarcely convex; right valve flat; hinge-line straight, shorter than the greatest width of the shell: anterior wing small, short, acute, separated from the body by a deep narrow sinus, not extending as far forward as the anterior margin of the shell; posterior wing short, broader than the anterior, acute at the extremity, not extending to the line of the posterior margin of the shell. Surface marked by a few unequal concentric wrinkles, and by fine, closely arranged, elevated, subimbricating, lamellose striæ, which extend over the wings in like manner. Central portion of the shell marked by faint radiating striæ." Hall, 1859.

This shell is cited by Hall as occurring in the Lower Helderberg rocks of Albany and Schoharie counties, New York. The individual at hand is a badly weathered left valve probably of this species.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## Order TELODESMACEA

### Superfamily CYPRICARDIACEA

### Family PLEUORPHORIDAE

#### Genus CYPRICARDINIA Hall

#### CYPRICARDINIA CF. LAMELLOSA Hall

Plate LXXVIII, Figs. 6, 7

*Cypricardinia lamellosa* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 266, pl. xlix*a*, figs. 1*a*, *b*, *c*, 1861.

*Description.*—"Shell subovoid, gibbous; umbones slightly elevated; anterior extremity abruptly rounded and extending little beyond the beak, somewhat contracted on the base anterior to the middle, with an undefined depression extending thence nearly to the umbones; posterior slope prominent, with a scarcely defined ridge; cardinal margin compressed, obliquely subtruncated above and rounded towards the base. Surface marked by strong elevated distant lamellæ; the surface of each one showing under a magnifier, distinct radiating striæ, and sometimes another set of striæ cancellating the first." Hall, 1859.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## CLASS GASTROPODA

### Subclass STREPTONEURA

### Order ASPIDOBRANCHIA

### Suborder RHIPIDOGLOSSA

### Family BELLEROPHONTIDAE

#### Genus BELLEROPHON Montfort

#### BELLEROPHON HELDERBERGIÆ n. sp.

Plate LXXIX, Figs. 3, 4

*Description.*—Convolute, volutions somewhat flattened dorso-ventrally; last volution expanding rapidly, aperture expanded. Umbilicus small. Dorsal carina pronounced. Surface ornamentation unknown.

This species differs from *Bellerophon auriculatus* in its more rapidly expanding volutions and distinct dorsal carina.

Diameter of shell 1.4 cm.; of aperture 1.5 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley.

*Collection.*—U. S. National Museum.

## Order CTENOBRANCHIATA

### Suborder PLATYPODA

### Superfamily GYMNOGLOSSA

### Family PYRAMIDELLIDAE

#### Genus LOXONEMA Phillips

LOXONEMA sp.

Plate LXXIX, Fig. 8

*Description.*—Pyramidal, apical angle small; volutions convex, their height about two-thirds of their diameter. Sutures straight, moderately deep. Surface ornamentation unknown.

Length 25 mm.; diameter of largest volution 9 mm.

The generic relations of this species are unknown. It differs from *Loxonema fitchi* in its less oblique volutions. It resembles *Loxonema* sp. described by Weller[1] from the Decker Ferry of New Jersey.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley.

*Collection.*—Maryland Geological Survey.

### Superfamily TAENIOGLOSSA

### Family LITTORINIDAE

#### Genus PLATYCERAS Conrad

PLATYCERAS TENUILIRATUM Hall?

Plate LXXXV, Figs. 1, 2

*Platyceras tenuiliratum* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 317, pl. lviii, figs. 1-5; and pl. lix, figs. 6*a*, *b*, 1861.

*Description.*—" Shell small, depressed, subovoid or subdiscoid, with the last volution very ventricose. Spire slightly raised above the plane of the

[1] Pal. N. J., vol. iii, 1903, pl. xxii, fig. 11.

outer volution: volutions about three, the first and second very minute, and the last one rapidly expanding; aperture campanulate, with the lip broadly reflexed on the posterior and part of the right side. Surface marked by fine thread-like striæ, which often become lamellose on the last volution, and these are cancellated by very fine revolving striæ." Hall, 1859.

*Occurrence.*—HELDERBERG FORMATION, KEYSER ? MEMBER. Cash Valley.

*Collection.*—U. S. National Museum.

### Genus PLATYOSTOMA Conrad

### PLATYOSTOMA NIAGARENSE Hall

Plate LXXXVII, Figs. 3, 4

*Platyostoma niagarense* Hall, 1852, Pal. N. Y., vol. ii, p. 287, pl. lx, figs. 1*a-v*.

*Description.*—" Globose; volutions three or four; body whorl large, inflated towards the aperture which is dilated; sutures deep; spire depressed (rarely elevated); shell thin; surface striated across the volutions, and in well-preserved specimens longitudinally marked by filiform undulating striæ. The spire appears to be depressed often when the shell retains its natural proportions, and at other times from pressure; in a few examples it is considerably elevated. The fine undulating longitudinal striæ do not always appear, and sometimes only upon a portion of the surface, even when there is no appearance of abrasion. In other examples they have evidently been worn off, leaving the transverse striæ well preserved." Hall, 1852.

Length 1.8 cm.; diameter 1.9 cm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Viaduct Cumberland.

*Collection.*—U. S. National Museum.

# Order OPISTHOBRANCHIATA

## Suborder CONULARIDA

### Family TENTACULIDAE

#### Genus TENTACULITES Schlotheim

#### TENTACULITES GYRACANTHUS (Eaton)

Plate LXXXVII, Fig. 11

*Echinus gyracanthus* Eaton, 1832, Geological Text Book.
*Tentaculites ornatus* Vanuxem, 1842, Final Rept. on the Geol. of the 3d Dist. N. Y., p. 112, fig. 3.
*Tentaculites ornatus* Mather, 1843, Final Rept. on the Geol. of the 1st Dist. N. Y., p. 349, fig. 3.
*Tentaculites irregularis* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 137, pl. vi, figs. 22, 23, 1861.
*Tentaculites gyracanthus* Hall, 1888, Nat. Hist. N. Y., Pal., vol. vii, p. 5 (supplement to vol. v), pl. cxiv, figs. 7-13.
*Tentaculites gyracanthus* Weller, 1903, Pal. N. J., vol. iii, p. 264, pl. xxiv, figs. 19, 20.

*Description.*—"Body small, acicular, tapering to an acute point. Annulations rounded, inequally distant, from six to twelve in the space of one-eighth of an inch: intermediate spaces marked with rounded annulating striæ. Length rarely more than half an inch." Hall, 1859.

"Shell elongate, circular in cross-section, annulate, gradually tapering to the apex. Annulations smooth, rounded, situated at irregular intervals, from one to three in the space of 1 mm.; the interspaces between the annulations are marked by fine, annular striæ. In internal casts the annulations are smaller and the fine, annular striæ are lacking from the interspaces." Weller, 1903.

This species occurs in great numbers in the Manlius formation of the Upper Silurian of New York and gave to this horizon its first name (Tentaculite limestone). It also occurs in large numbers in the Tonoloway formation and locally in the upper part of the Keyser member of the Helderberg.

Length 5.6 mm.; diameter .7 mm.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Keyser, West Virginia; Dawson, Devil's Backbone, Tonoloway, Maryland.

*Collection.*—Maryland Geological Survey.

# Class CEPHALOPODA

## Subclass TETRABRANCHIATA

### Order NAUTILOIDEA

### Suborder ORTHOCHOANITES

#### Family ORTHOCERATIDAE

Genus ORTHOCERAS Breyn

ORTHOCERAS SCHUCHERTI n. sp.

Plate LXXXVIII, Fig. 4

*Description.*—Shell subcylindrical, tapering very gradually; septa convex, siphuncle not observed. Surface marked by numerous simple rounded somewhat abruptly elevated concentric annulations, at least five occurring in the space of 10 mm. Surface too badly weathered to observe any transverse or longitudinal striæ if present.

This species closely resembles *Orthoceras tenuiannulatum* (Hall) of the Helderberg. It may be distinguished, however, by its smaller apical angle and by possessing shallower and more numerous annulations.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cumberland.

*Collection.*—U. S. National Museum.

ORTHOCERAS RIGIDUM Hall?

Plate LXXXVIII, Fig. 5

*Orthoceras rigidium* Hall, 1859, Nat. Hist. N. Y., Pal., vol. iii, p. 344, pl. lxx, figs. 3*a-d*, 1861.

*Description.*—"Shell elongate, gradually tapering; section circular. Septa moderately convex, distant from each other about one-sixth the diameter of the tube. Siphuncle central, narrow in its passage through the septum. Surface marked by fine sharply elevated equal transverse striæ." Hall, 1859.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone.

*Collection.*—Maryland Geological Survey.

# ARTHROPODA

## Subbranch BRANCHIATA

## CLASS CRUSTACEA

## Subclass TRILOBITA

## Order OPISTHOPARIA

### Family PROETIDAE

Genus PROËTUS Steininger

PROËTUS PACHYDERMATUS Barrett

Plate LXXXIX, Fig. 1

*Proëtus pachydermatus* Weller, 1903, Pal. N. J., vol. iii, p. 248, pl. xxii, figs. 16-21.

*Description.*—"Head semicircular in outline, with a broad, flattened, marginal border, the genal angles produced into sharp spines. Glabella subtriangular, with a pair of small, disconnected, ovoid basal lobes, obtusely pointed in front, bordered by a sharply defined dorsal furrow; the first and second pairs of lateral furrows are rather faint, slightly curved and directed obliquely backward from the margin of the glabella; the third pair more prominent, curved, directed backward and connecting with the occipital furrow by a less sharply defined depression. Cheeks convex to the marginal border, the eyes opposite the third pair of lateral glabellar furrows. Facial sutures making a sigmoidal curve from the anterior margin of the head to the front of the eye-lobe, and after passing around the eye, bending outward and cutting the posterior margin near the base of the genal spines. Occipital segment broadened in the middle with a small median tubercle. Thorax unknown. Pygidium semielliptical in outline, broader than long, with a broad, flattened, marginal border; the axis much elevated, occupying about one-third the entire width in front, tapering gradually to the obtusely rounded extremity which lies just within the flattened border, divided into thirteen or fourteen segments; the pleuræ strongly convex to the flattened border, divided into eight or nine sharply grooved segments, which become obsolete at the marginal border.

"The entire surface of the glabella except the lateral furrows, also the axial portion of the occipital segment, covered with fine, irregular papillæ; the anterior portion of the cheeks is covered with elongate, raised, vermiform markings, which become shorter and papillose posteriorly. The marginal border and genal spines are smooth, except on the edge, where they are covered with fine, elongate, raised lines. The axial and pleural segments of the pygidium are papillose, the flattened border being smooth within, but toward the margin covered with fine, raised tubercles and elongate flexuose markings." Weller, 1903.

This species was discovered and named by Dr. S. T. Barrett; who gave a brief description of it. By him it was found in the "Coralline limestone" and is cited by Weller from the Decker Ferry formation of New Jersey. It is not unlikely that the single specimen from Maryland may have come from the Keyser member.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cumberland.

*Collection.*—George M. Roeder.

## Order PROPARIA

### Family CALYMENIDAE

#### Genus CALYMENE Brongniart

#### CALYMENE CAMERATA Conrad

Plate LXXXIX, Fig. 9

*Calymene camerata* Conrad, 1842, Jour. Acad. Nat. Sci., Phila., vol. viii, p. 278.

*Calymene camerata* Hall, 1852, Pal. N. Y., vol. ii, p. 337, pl. lxxviii, figs. 1*a-f*.

*Description.*—"Cephalic shield wide, subcrescent form; anterior margin elevated in a strong fold, a deep groove separating it from the front of the glabella and cheeks; glabella broader and nearly straight in front, furnished on each side with three distinct tubercles, the posterior one very large and prominent, the anterior one minute; eyes opposite to the central lobe of the glabella; the furrow between the glabella and cheeks very deep; a projecting lobe from behind the eye touches or unites

with the middle of the three lobes of the glabella, and a similar projecting plate from the inner anterior angle of the cheek touches the front lobe of the glabella near its anterior angle. Axis of the body convex, nearly as wide as the lateral lobes; pleura convex and straight for half their length, and then gently curved downwards and flattened, grooved along the center. Caudal shield with eight rings in the middle lobe; lateral lobes with six flat ribs strongly bent downwards; surface granulate, with larger tubercles on the glabella and other parts.

"The specimens examined are all imperfect, and the surface markings are also more or less obliterated. The characteristic features are the deep furrow along the front and cheek margins, and between the glabella and cheeks, and the projecting lobes from the inner margins of the cheeks which touch or unite with the glabella, arching over the axial furrow. In the two separated cephalic shields, the portion beyond the facial suture is wanting, and in the more entire specimen it is too obscure to be characterized." Hall, 1852.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Cash Valley, Devil's Backbone, Maryland; Keyser, West Virginia.

*Collection.*—U. S. National Museum.

## Family PHACOPIDAE

### Genus DALMANITES Emmrich

### DALMANITES ASPINOSUS Weller

Plate XCI, Fig. 16

*Dalmanites aspinosa* Weller, 1903, Pal. N. J., vol. iii, p. 252, pl. xxii, fig. 15.

*Description.*—"Known only from the pygidium which is longitudinally semielliptical in outline, obtusely pointed posteriorly. Axis regularly tapering and rounded posteriorly; in the type specimen reaching to within 4.5 mm. of the posterior margin, which makes it about six-sevenths of the entire length of the pygidium; marked by about 16 annulations, which gradually decrease in size posteriorly until they become entirely obsolete. The pleura are rather strongly convex to the margin, with no flattened or concave border; marked by ten prominent, narrow grooved ribs, which

extend to the margin of the pygidium and are separated by broad, concave furrows. The dimensions of the type specimen are: Length 32 mm.; width 40 mm.; convexity 9 mm." Weller, 1903.

The individuals in Maryland are smaller than those from New Jersey. However, the characteristics, *i. e.,* the absence of any spinous extension from the posterior extremity, the absence of any flattened or concave marginal border and the sharp pleural angular ribs which are present, distinguish this species conspicuously from other members of the genus.

*Occurrence.*—HELDERBERG FORMATION, KEYSER MEMBER. Devil's Backbone, Cash Valley.

*Collection.*—U. S. National Museum.

## LIFE

Thomas Poole Maynard was born in Baltimore, Maryland, February 15, 1883. His early education was received in the Deichman Preparatory School of Baltimore. He entered the Johns Hopkins University in the fall of 1901 and was graduated from that university in the spring of 1905 with the degree of Bachelor of Arts. He entered the Department of Geology in the Johns Hopkins University in the fall of 1905 and has since pursued graduate work under Professor Wm. Bullock Clark, Professor Harry Fielding Reid, Professor E. B. Mathews, and Dr. C. K. Swartz. to whom he wishes to express his indebtedness for many courtesies.

In 1905-1906 he was Student Assistant to Dr. C. K. Swartz in mineralogy, and, in 1906, 1907, and 1908 he was Student Assistant in economic geology to Professor Wm. Bullock Clark.

The summer of 1906 was spent in the economic development of the iron ores of Columbiana Mountain, Alabama, and in reconnaissance work in the Coosa and Big Warrior coal fields of Alabama. Some time was spent during the summers of 1907 and 1908 under the supervision of the Virginia Geological Survey and in a study of the slates of Virginia.

The summers of 1905, 1907, and 1908 were spent under the supervision of the Maryland Geological Survey in assisting Dr. C. K. Swartz in the study of the Devonian of Maryland, and the summer of 1908 in the field work for this dissertation.